US Army Corps of Engineers.
Construction Engineering Research Laboratory

Fact Sheet

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LEAD-BASED PAINT ABATEMENT USING MICROWAVES

The Problem

Exposure to lead is associated with adverse health effects, with young children at greatest risk. Lead exposure can result from ingesting paint chips or dust from deteriorating house paints or from improper paint removal. While lead has not been used in house paints since the 1978 United States Ban, old paint with hazardous lead levels still remain on many surfaces.

The Army owns 95,400 family housing units in the United States and 26,200 in foreign countries. The average age of these facilities is 36 years, with 90,000 of these units predating 1978 and most likely containing lead-based paint. About 6,800 of these facilities are historic/eligible and require special procedures for preservation. Also included are also 256 child care-centers. Assuming that there are 90,000 buildings constructed before 1978 with lead-based paint, the total painted surface area equals some 1 billion square feet. The Army also owns buildings (other than family housing and child-occupied facilities) with a footprint of approximately 800 million square feet which have an estimated 1 billion square feet of wall surfaces that contain lead-based paint.

Abrasive blasting, a common method to remove lead-based paint from exterior building surfaces, cannot be used in building interiors due to the hazardous lead dust generated. Alternative, cost-effective procedures for lead abatement need to be provided for a lead hazard-free environment.

The Technology

The U.S. Army Construction Engineering Research Laboratory (CERL) is demonstrating emerging technologies and developing new technologies for the control of lead-based paint hazards in buildings.

A microwave-assisted removal process for lead-based paint from wood and composite surfaces has been developed and patented (U.S. Patent No. 5,268,548) at CERL. In the microwave-assisted removal process, microwave coupling compounds are applied as a waterborne slurry or as a polymer binder paste to the painted surface. Microwaves have the unique capability to rapidly and selectively heat the coated surface. Microwave coupling compounds such as graphite can reach temperatures up to 1000 C in less than a minute when exposed to microwaves (800 watts). These susceptor materials increase both the efficiency of the system as well as the uniformity of the heating process. The microwave applicator uses standard magnetron tubes similar to those used in household microwave ovens. The applicator horn is designed to focus microwave energy onto the susceptor where it is used effectively. The paint is debonded from the substrate by heat from the microwaves and is removed easily by scraping. Since the airborne lead levels are below the threshold requirements set by the Environmental Protection Agency (EPA) and Occupational Safety and Hazard Administration (OSHA), containment structures are not needed and the extent of environmental and worker health monitoring is reduced, resulting in cost savings. The microwave removal system provides a safer environment for workers as well as a better alternative to the current means of lead-based paint removal on interior surfaces.

Use of the microwave-assisted paint stripping process in combination with a chemical stabilizer, such as a calcium silicate or phosphate-based material, is currently undergoing laboratory testing. The chemical stabilizer would be applied in conjunction with the susceptor to the painted surface. Following removal of the paint, the chemical stabilizer would react with and immobilize the lead from the paint and make the resulting waste non-hazardous as determined using the Toxicity Characterization Leaching Procedure (TCLP). This would eliminate the cost associated with the disposal of a hazardous waste.

Status

A proof-of-principal field test of microwave paint stripping was conducted on an Army building near Lexington, KY in December 1997. A field-portable microwave system was successfully used to remove lead-based paint from an interior wooden door and doorsill. Both graphite and polyaniline susceptor materials were used successfully in the test. The lead levels on the wood were dramatically reduced on the areas stripped. The removal rate during the field test was the same rate achieved in the laboratory. This work is continuing to improve the removal rate and efficiency. A demonstration is planned at Ft. Lewis during March 1999.

Benefits/Savings

This work will yield a dust-free method of lead-based paint removal that is safe for the workers conducting the removal and for the environment surrounding the site as well as yielding a waste that is non-hazardous. In addition, this method could significantly reduce the cost and liability of lead-based paint abatement when compared to the current means of hazardous lead-based paint removal and disposal.

Point of Contact

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